

PATENT
Docket No. 150.00640102

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Eugene P. Marsh)

Group Art Unit: 2815)

Serial No.: 09/942,200)

Examiner: J. Nguyen)

Confirmation No.: 8194)

Filed: 29 August 2001)

For: DIFFUSION BARRIER LAYERS AND METHODS OF FORMING SAME

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Mueting, Raasch & Gebhardt, P.A.

Customer Number: 26813

3 August 2004

Date

By: Matthew W. Adams

Matthew W. Adams

Reg. No. 43,459

Direct Dial (612)305-1227

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3 August 2004

Date

Signature: Sara E. OlsonName: Sara E. Olson

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PATENT
Docket No. 150.00640102IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Eugene P. Marsh) Group Art Unit: 2815
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OFFICIALCOMMUNICATION REGARDING SUBMISSION
OF DUPLICATE PAPERS

Commissioner for Patents
Mail Stop Amendment
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Pursuant to a telephone conversation between Ms. Sara Olson (of Mueeting, Raasch & Gebhardt) and Examiner B. Sircus of Group Art Unit 2836, it appears that Applicant's previously-submitted communication (an Amendment and Response filed 29 March 2004) in the above-identified matter was never matched with the correct PTO file. Rather, the papers appear to have been inadvertently matched to U.S. Pat. App. Ser. No. 09/942,220 in Examiner Sircus's GAU. It is respectfully requested that these erroneously matched papers be removed from that file immediately.

Examiner Sircus further recommended that we file a duplicate copy of the previously-submitted communication. Accordingly, please find enclosed a copy of the papers originally filed 29 March 2004 in this matter. Specifically, these documents include copies of:

- a facsimile transmission cover sheet;
- a Petition for Extension of Time (with authorization to charge a deposit account in the amount of \$420 for a two month extension of time);
- an Amendment and Response; and
- a Declaration under 37 C.F.R. § 1.131 (including Exhibits A and B).

Communication Regarding Submission of Duplicate Papers

Page 2 of 2

Applicant(s): Eugene P. Marsh

Serial No.: 09/942,200

Filed: 29 August 2001

For: DIFFUSION BARRIER LAYERS AND METHODS OF FORMING SAME

Also enclosed herewith is a copy of the PTO "Auto-Reply Facsimile Transmission" sheet verifying receipt of these papers on 29 March 2004. As these papers were filed in a timely manner (and deposit account 13-4895 was charged for the appropriate extension fee as identified below), it is not believed that any additional fees are due.

It is further noted that Applicant's representatives' deposit account incurred three separate charges with respect to this matter on 3 May 2004. These charges were in the amounts of \$420, \$86, and \$72 (see PTO "POSTING REF TXT" 09942200). It appears that the \$420 charge was for the two month extension of time. However, Applicant does not understand the \$86 and the \$72 charges as no new claims were presented with this Amendment. As a result, Applicant respectfully requests reconsideration and a credit for these two charges.

The Examiner is invited to contact Applicants' Representatives, at the below-listed telephone number, if it is believed that prosecution of this application may be assisted thereby.

CERTIFICATE UNDER 37 C.F.R. 1.8:

The undersigned hereby certifies that this paper is being transmitted by facsimile in accordance with 37 CFR §1.6(d) to the Patent and Trademark Office, addressed to Commissioner for Patents, Mail Stop Amendment, P.O. Box 1450, Alexandria, VA 22313-1450, on this 3rd day of August, 2004, at 11:53am (Central Time).


Name: Sana E. OLSON

Respectfully submitted by

Mueting, Raasch & Gebhardt, P.A.
P.O. Box 581415
Minneapolis, MN 55458-1415
Phone: (612)305-1220
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Customer Number 26813

3 August 2004

Date

By: 

Matthew W. Adams

Reg. No. 43,459

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PATENT
Docket No. 150.00640102IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**COPY**

Applicant(s): Eugene P. Marsh) Group Art Unit: 2815
Serial No.: 09/942,200) Examiner: J. Nguyen
Confirmation No.: 8194)
Filed: 29 August 2001)
For: DIFFUSION BARRIER LAYERS AND METHODS OF FORMING SAME

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Commissioner for Patents
Attn: Examiner J. Nguyen
P.O. Box 1450
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FAX NUMBER: (703) 872- 9306
Total Pages (including cover page): 13
Time: 2:15pm (Central Time)
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Please charge Deposit Account No. 13-4895 in the amount of \$420.00 for the 2 month Extension of Time Fee.

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Mueting, Raasch & Gebhardt, P.A.
Customer Number: 26813

29 Mar. 2004
Date

By: Matthew W. Adams
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Reg. No. 43,459
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29 Mar. 2004
Date

Signature: Sam E. Olson
Name: SAM E. OLSON

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Group Art Unit: 2815
Examiner: J. Nguyen

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Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In accordance with the provisions of 37 C.F.R. §1.136(a), it is respectfully requested that a 2-month extension of time be granted in which to respond to the outstanding Office Action mailed October 29, 2003, thereby extending the date on which the period of response is set to expire from January 29, 2004 to March 29, 2004.

Please charge Deposit Account No. 13-4895 in the amount of \$420.00 to cover the required extension fee. Please charge any additional fees or credit any over-payment to PTO Deposit Account No.13-4895.

Respectfully submitted for
Eugene P. Marsh

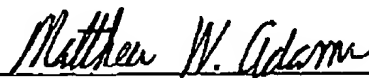
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Name: SARA E. OLSON

29 March 2004
Date

By
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Minneapolis, MN 55458-1415
Phone: (612)305-1220
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Customer Number 26813

By: 
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Serial No.: 09/942,200) Examiner: J. Nguyen
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PATENT
Docket No. 150.00640102
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AMENDMENT AND RESPONSE

Assistant Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

In response to the Office Action of 29 October 2003, please amend the above-identified application as follows:

Amendments to the Claims are reflected in the listing of claims which begins on the page entitled "Amendments to the Claims."

Remarks begin on the page entitled "Remarks."

COPY**Amendment and Response**

Page 2

Serial No.: 09/942,200

Confirmation No.: 8194

Filed: 29 August 2001

For: DIFFUSION BARRIER LAYERS AND METHODS OF FORMING SAME**Amendments to the Claims**

This listing of claims replaces all prior versions, and listings, of claims in the above-identified application:

Listing of Claims

1-22. (CANCELED)

23. (CURRENTLY AMENDED) A semiconductor device structure, the structure comprising:

a substrate assembly including a surface; and

a chemical vapor deposited barrier layer over at least a portion of the surface, wherein the barrier layer is formed of a platinum(x):ruthenium(1-x) alloy, where x is in the range of about 0.60 to about 0.995, and further wherein the barrier layer is substantially free of carbon.

24. (ORIGINAL) The structure of claim 23, wherein x is in the range of about 0.90 to about 0.98.

25. (ORIGINAL) The structure of claim 24, wherein x is about 0.95.

26. (ORIGINAL) The structure of claim 23, wherein the portion of the surface is a silicon containing surface.

27. (CURRENTLY AMENDED) A capacitor structure comprising:

a first electrode;

a dielectric material on at least a portion of the first electrode; and

a second electrode on the dielectric material, wherein at least one of the first electrode and second electrode comprises a chemical vapor deposited barrier layer of

COPY**Amendment and Response**

Page 3

Serial No.: 09/942,200

Confirmation No.: 8194

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For: DIFFUSION BARRIER LAYERS AND METHODS OF FORMING SAME

platinum(x):ruthenium(~~1-x~~) alloy ; ~~and further wherein the barrier layer is substantially free of carbon.~~

28. (ORIGINAL) The structure of claim 27, wherein x is in the range of about 0.60 to about 0.995.

29. (ORIGINAL) The structure of claim 28, wherein x is in the range of about 0.90 to about 0.98.

30. (CURRENTLY AMENDED) The structure of claim 27, wherein at least one of the first electrode and second electrode comprises the barrier layer of platinum(x):ruthenium(~~1-x~~) alloy and one or more additional conductive layers.

31. (PREVIOUSLY PRESENTED) The structure of claim 30, wherein the one or more additional conductive layers are formed from materials selected from the group of metals and metal alloys; metal and metal alloy oxides; metal nitrides; and metal silicides.

32. (CURRENTLY AMENDED) A memory cell structure comprising:
a substrate assembly including at least one active device; and
a capacitor formed relative to the at least one active device, the capacitor comprising at least one electrode including a chemical vapor deposited barrier layer formed of platinum(x):ruthenium(~~1-x~~) alloy ; ~~wherein the barrier layer is substantially free of carbon.~~

33. (CURRENTLY AMENDED) The structure of claim 32, wherein the capacitor includes:
a first electrode formed relative to a silicon containing region of the at least one active device;
a dielectric material on at least a portion of the first electrode; and

Amendment and Response

Serial No.: 09/942,200

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For: DIFFUSION BARRIER LAYERS AND METHODS OF FORMING SAME

COPY

Page 4

a second electrode on the dielectric material, wherein the first electrode comprises the barrier layer formed of platinum(x):ruthenium(1-x) alloy.

34. **(CURRENTLY AMENDED)** The structure of claim 33, wherein the first electrode comprising the barrier layer formed of platinum(x):ruthenium(1-x) alloy includes one or more additional conductive layers.

35. **(ORIGINAL)** The structure of claim 33, wherein x is in the range of about 0.60 to about 0.995.

36. **(ORIGINAL)** The structure of claim 35, wherein x is in the range of about 0.90 to about 0.98.

37. **(CURRENTLY AMENDED)** An integrated circuit structure comprising:
a substrate assembly including at least one active device; and
an interconnect formed relative to the at least one active device, the interconnect including a barrier layer formed of platinum(x):ruthenium(1-x) alloy.

38. **(ORIGINAL)** The structure of claim 37, wherein x is in the range of about 0.60 to about 0.995.

39. **(ORIGINAL)** The structure of claim 38, wherein x is in the range of about 0.90 to about 0.98.

40. **(CANCELED)**

41. **(PREVIOUSLY PRESENTED)** The structure of claim 23, wherein the at least a portion of the surface defines a small high aspect ratio opening.

COPY**Amendment and Response**

Page 5

Serial No.: 09/942,200

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For: DIFFUSION BARRIER LAYERS AND METHODS OF FORMING SAME

42. **(PREVIOUSLY PRESENTED)** The structure of claim 23, wherein a thickness of the barrier layer is in a range of about 10 Å to about 10,000 Å.
43. **(PREVIOUSLY PRESENTED)** The structure of claim 42, wherein the thickness of the barrier layer is in a range of about 100 Å to about 500 Å.
44. **(PREVIOUSLY PRESENTED)** The structure of claim 23, wherein the substrate assembly comprises at least one active device.
45. **(PREVIOUSLY PRESENTED)** The structure of claim 37, wherein the barrier layer comprises a chemical vapor deposited barrier layer.
46. **(PREVIOUSLY PRESENTED)** The structure of claim 37, wherein the substrate assembly comprises a small high aspect ratio opening, and further wherein the interconnect is formed in the small high aspect ratio opening relative to the at least one active device.
47. **(PREVIOUSLY PRESENTED)** The structure of claim 37, wherein a thickness of the barrier layer is in a range of about 10 Å to about 10,000 Å.
48. **(PREVIOUSLY PRESENTED)** The structure of claim 47, wherein the thickness of the barrier layer is in a range of about 100 Å to about 500 Å.
49. **(PREVIOUSLY PRESENTED)** The structure of claim 39, wherein x is about 0.95.

COPY**Amendment and Response**

Page 6

Serial No.: 09/942,200

Confirmation No.: 8194

Filed: 29 August 2001

For: DIFFUSION BARRIER LAYERS AND METHODS OF FORMING SAME**Remarks**

The Office Action of 29 October 2003 has been received and reviewed. With claims 23, 27, 30, 32-34, and 37 having been amended, and claim 40 having been canceled, the pending claims are claims 23-39 and 41-49. Reconsideration and withdrawal of the rejection are respectfully requested for at least the reasons presented below.

Claim Amendments

The broadening amendments made herein are, Applicant submits, supported by the Declaration under 37 C.F.R. § 1.131 (the "Declaration") filed herewith.

The 35 U.S.C. §103 Rejection

Claims 23-49 were rejected under 35 U.S.C. §103(a) as being unpatentable over Dornfest et al. (U.S. Patent No. 6,358,810) in view of Smith et al. (U.S. Patent No. 5,149,596). While Applicant does not agree with the substance of the rejection (e.g., the Office Action has not identified, for example, the range of x recited in claims 24, 25, 36, 39, and 49), the rejection is rendered moot by the Declaration filed herewith.

The Declaration includes evidence that Applicant reduced at least the invention embodied in claims 23 and 37 to practice prior to the effective date of Dornfest et al. Applicant further submits that the claims that depend from claims 23 and 37, e.g., claims 24-26 and 41-44; and claims 38-39 and 45-49, respectively, were also reduced to practice prior to the effective date of Dornfest et al., or are species claims as further described below. For example, a platinum(x):ruthenium layer wherein x is within the range of values (or is equal to the value) recited in claims 24-25, 38-39, and 49 is shown in the Exhibits of the Declaration. Further, for example, the Declaration describes a barrier layer having a thickness within the ranges recited by claims 42-43 and 47-48, and further describes the silicon substrate and CVD process recited in claims 26 and 45, respectively.

Applicant submits that claim 23, directed to a semiconductor device structure, and claim 37, directed to an integrated circuit structure, are generic claims of the disclosed invention.

COPY**Amendment and Response**

Page 7

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Moreover, independent claim 27, which is directed to a capacitor structure, and independent claim 32, which is directed to a memory cell structure, are submitted to be species within the genus of claims 23 and 37, as are various other dependent claims including, for example, claims 41, 44, and 46. In view thereof, such claims are also deemed to have been reduced to practice.

In view of the evidence antedating Dornfest et al., Applicant requests reconsideration and withdrawal of the pending rejection.

Summary

It is submitted that pending claims 23-39 and 41-49 are in condition for allowance and notification to that effect is requested. The Examiner is invited to contact Applicants' Representatives, at the below-listed telephone number, if it is believed that prosecution of this application may be assisted thereby.

Respectfully submitted for
Eugene P. Marsh

By
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Customer Number 26813

29 Mar. 2004
Date

By: Matthew W. Adams
Matthew W. Adams
Reg. No. 43,459
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By: Sam E. Olson
Name: SAM E. OLSON

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Applicant(s): Eugene P. Marsh)	Group Art Unit:	2815
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For: DIFFUSION BARRIER LAYERS AND METHODS OF FORMING SAME)		

DECLARATION UNDER 37 C.F.R. § 1.131

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

I, Eugene P. Marsh, declare and say as follows:

1. I am the inventor of the subject matter claimed in U.S. Patent Application Serial No. 09/942,200, filed 29 August 2001, which is a divisional application of U.S. Patent Application Serial No. 09/146,866, filed 3 September 1998, and issued as U.S. Patent No. 6,323,081 B1, on 27 November 2001.
2. I received a PhD. from the University of California, Santa Barbara. I have been employed at Micron Technology, Inc. since November 1995.
3. Prior to 28 July 1998, I conceived of using a platinum-ruthenium alloy as a barrier layer for use in semiconductor device structures, as described below and shown in the accompanying Exhibits.
4. I reduced to practice a platinum-ruthenium alloy as a barrier layer for use in semiconductor device structures before 28 July 1998, which is the U.S. filing date for U.S. Patent No. 6,358,810 B1 to Dornfest et al., issued 19 March 2002 (hereinafter "Dornfest et al.").
5. Exhibit A shows an X-ray photo-electron spectroscopic (XPS) depth profile, taken prior to 28 July 1998, of a platinum-ruthenium alloy having a composition of platinum(x): ruthenium. The platinum-ruthenium alloy analyzed in Exhibit A was produced by CVD co-

COPY*Declaration Under 37 C.F.R. § 1.131**Serial No.: 09/942,200**Confirmation No.: 8194**Filed: 29 August 2001**Title: DIFFUSION BARRIER LAYERS AND METHODS OF FORMING SAME*

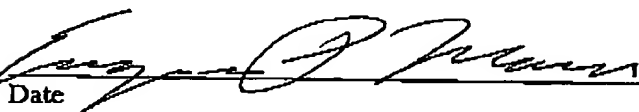
Page 2

deposition of platinum and ruthenium on a silicon (Si) substrate. The resulting structure of Exhibit A includes an upper platinum "electrode" layer having a thickness of about 300 Angstroms located over the platinum(x):ruthenium alloy barrier layer, which has a thickness of about 200 Angstroms. As illustrated in this exhibit, x may encompass a range, e.g., about 0.60 to about 0.995, that is within the ranges defined in the pending claims of the captioned application. The data presented in Exhibit A was measured after anneal in an oxygen atmosphere.

6. Exhibit B shows an XPS montage plot, taken prior to 28 July 1998, of a co-deposited platinum(x):ruthenium layer on a Si substrate after a rapid thermal oxidation process at 750 degrees C. This montage plot corresponds to the structure represented in Figure 6B of the application. The montage plot illustrates binding energies measured over a range of relative depths ("cycles"). The plot indicates a photoelectron peak corresponding to Si 2p at the interface between the deposited layer and the Si substrate. However, there is no peak corresponding to SiO₂ and, as such, demonstrates a lack of SiO₂ at the interface of the deposited layer and the Si substrate. This lack of SiO₂ at the interface indicates that the deposited platinum-ruthenium alloy is usable as an effective barrier layer.

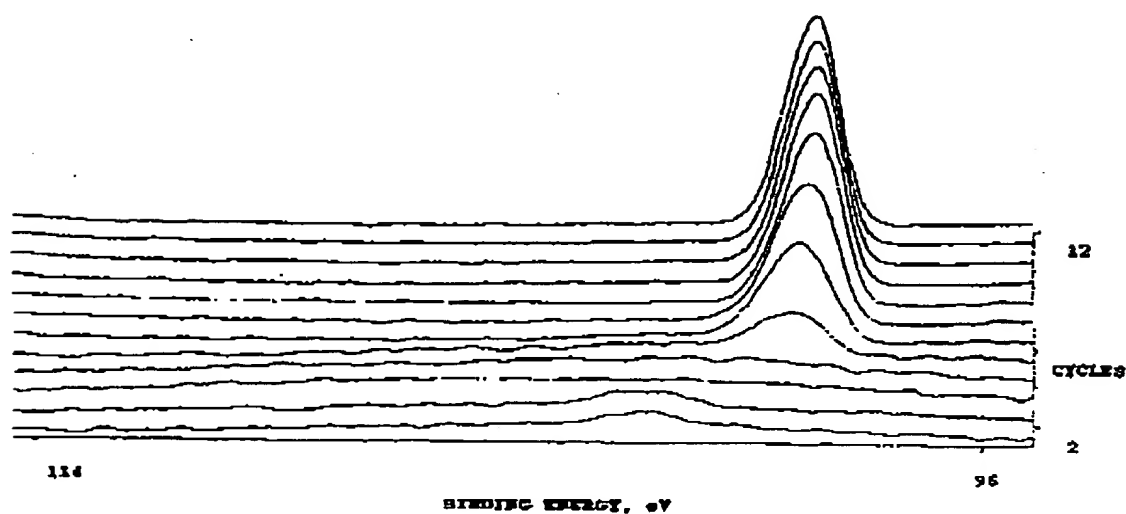
7. On information and belief pursuant to the facts and evidence provided herein, the invention embodied within the structure described above was reduced to practice prior to the filing date of Dornfest et al.

8. I further declare that statements made herein of my knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.



Date

3/26/04
Eugene P. Marsh

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TO:

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			By: Matthew W. Adams Matthew W. Adams Reg. No. 43,459 Direct Dial (612)305-1227		
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